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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Application Number: 10/792,127
Filing Date: March 04, 2004
Appellant(s): TONG ET AL.

John R Witcher, III
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 9/7/2010 appealing from the Office action mailed 10/13/09.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The following is a list of claims that are rejected and pending in the application:

Claims 2-4, 6-13, 15-28, 32-43, 48-55 and 57-60 are rejected.

Claim 5 is allowed.

Claims 14 and 44-47 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

(4) Status of Amendments After Final

The examiner has no comment on the appellant's statement of the status of amendments after final rejection contained in the brief.

(5) Summary of Claimed Subject Matter

The examiner has no comment on the summary of claimed subject matter contained in the brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The examiner has no comment on the appellant's statement of the grounds of rejection to be reviewed on appeal. Every ground of rejection set forth in the Office action from which the appeal is taken (as modified by any advisory actions) is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading "WITHDRAWN REJECTIONS." New grounds of rejection (if any) are provided under the subheading "NEW GROUNDS OF REJECTION."

(7) Claims Appendix

The examiner has no comment on the copy of the appealed claims contained in the Appendix to the appellant's brief.

(8) Evidence Relied Upon

6,873,606	AGRAWAL ET AL	3-2005
2005/0053170	CATREUX ET AL	3-2005
5,828,658	OTTERSTEN ET AL	10-1998

(9) Grounds of Rejection

The following grounds of rejection are applicable to the appealed claims:

I. Claims 2-4, 6-8, 13, 15-20, 22, 26-28, 32, 34, 35, 38-43, 48-55 and 57-60 are rejected under 35 U.S.C. 102(e) as being anticipated by Agrawal et al (US 6,873,606).

Regarding claims 13, 15, 16, 39-42 and 48, Agrawal discloses a method of processing signals to be transmitted on a plurality of communication channels (column 3, lines 17-28) using the system shown in figure 2. Each data stream is scaled with a respective weight corresponding to the amount of transmit power allocated to that stream (abstract). The weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The reference discloses coding the signals for transmission using the signal weights. A receiver will conduct the opposite (inverse) of the coding process to recover the original data. Therefore, the received signals are decoded using an inverse of the encoding process.

Regarding claim 2, Agrawal discloses the channel response estimate and received SNR is received from the receiver (column 10, lines 4-17).

Regarding claims 3, 4, 6-8 and 43, Agrawal further discloses the method of figure 1. The data streams forms a diagonal matrix, selects a transmit basis matrix and scales each element with its associated weight. Off diagonal elements of the diagonal matrix

will be forced to zero. Agrawal discloses the receive vector equals the effective channel response matrix times the input times the diagonal matrix in column 4, lines 49-62.

Regarding claim 49, Agrawal discloses a receiver in figure 2 for recovering the originally transmitted signal (column 9, lines 51-62).

Regarding claims 17, 19, 22, 26, 28, 49, 50 and 51, Agrawal discloses a method of processing signals to be transmitted on a plurality of communication channels (column 3, lines 17-28) using the system shown in figure 2. Each data stream is scaled with a respective weight corresponding to the amount of transmit power allocated to that stream (abstract). The weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). Agrawal discloses a receiver in figure 2 for recovering the originally transmitted signal (column 9, lines 51-62). The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The reference discloses coding the signals for transmission using the signal weights. A receiver will conduct the opposite (inverse) of the coding process to recover the original data. Therefore, the received signals are decoded using an inverse of the encoding process.

Regarding claim 18, Agrawal discloses the channel response estimate and received SNR is received from the receiver (column 10, lines 4-17).

Regarding claims 20 and 27, Agrawal further discloses the method of figure 1. The data streams forms a diagonal matrix, selects a transmit basis matrix and scales

each element with its associated weight. Off diagonal elements of the diagonal matrix will be forced to zero.

Regarding claims 32, 52, 54 and 55, Agrawal discloses a system for processing signals to be transmitted on a plurality of communication channels (column 3, lines 17-28 and figure 2). Each data stream is scaled with a respective weight corresponding to the amount of transmit power allocated to that stream (abstract). The weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The reference discloses coding the signals for transmission using the signal weights. A receiver will conduct the opposite (inverse) of the coding process to recover the original data. Therefore, the received signals are decoded using an inverse of the encoding process.

Regarding claims 34 and 53, Agrawal discloses a receiver in figure 2 for recovering the originally transmitted signal (column 9, lines 51-62).

Regarding claims 35 and 38, Agrawal discloses a method of processing signals to be transmitted on a plurality of communication channels (column 3, lines 17-28) using the system shown in figure 2. Each data stream is scaled with a respective weight corresponding to the amount of transmit power allocated to that stream (abstract). The weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). Agrawal discloses a receiver in figure 2 for recovering the

originally transmitted signal (column 9, lines 51-62). The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The reference discloses coding the signals for transmission using the signal weights. A receiver will conduct the opposite (inverse) of the coding process to recover the original data. Therefore, the received signals are decoded using an inverse of the encoding process.

Regarding claims 57-60, Agrawal discloses the communication system shown in figure 2. The system discloses the transmitter comprises t antennas and the receiver comprises r antennas. Therefore, the total number of antennas can be greater than 4 for each of the transmitters and receivers. The sub-groups are equal to the number of transmit antennas and the receive antennas. This number will be greater than 2. The communication channels used will also be greater than 2.

II. Claims 10-12, 23-25, 33, 36 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agrawal et al (US 6,873,606) in view of Catreux et al (US 2005/0053170).

Regarding claims 10-12, 23, 25 and 37, Agrawal discloses the method and system stated above. Agrawal does not disclose an interference cancellation takes place. Catreux discloses the system and method for using the system shown in figure 5A. Channel stat information is used to weight signals in the MIMO system. Paragraph 0043 discloses one embodiment of the process for removing inter-symbol interference

where the transmit signal is weighted with the inverse of the channel response at that frequency. Removing interference will allow the transmitted signal to be recovered correctly at the receiver. Other interference cancellation techniques are disclosed (paragraph 0010). It would have been obvious for one of ordinary skill in the art at the time of the invention to implement the interference cancellation techniques of Catreux in the method and system of Agrawal for the reason stated above.

Regarding claim 24, Catreux discloses using a MLSE equalizer and decoder at the receiver (figure 3).

Regarding claim 33, Agrawal discloses the method and system stated above. Agrawal does not disclose The MIMO system is a MIMO BLAST system. Catreux discloses V-BLAST MIMO systems realize very high data rates in rich scattering wireless channels (paragraph 0010), realizing very high data rates allow information to be transmitted and processed in less time than other systems. For this reason, it would have been obvious for one of ordinary skill in the art at the time of the invention to combine the teaching of Catreux into the system of Agrawal.

Regarding claim 36, Agrawal discloses the method and system stated above. Agrawal does not disclose the processor system a ML decoder. Catreux discloses using a MLSE equalizer and decoder at the receiver (figure 3). The use of this decoder helps to offset the effects of frequency-selective fading as described in paragraphs 0039-0040. Fading causes errors in the transmitted signal. It would have been obvious for one of ordinary skill in the art at the time of the invention to combine the teachings of

Catreux into the system of Agrawal to compensate for fading for the reason stated above.

III. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Agrawal et al (US 6,873,606) in view of Ottersten et al (US 5,828,658).

Regarding claim 21, Agrawal discloses the method and system stated above. Agrawal does not disclose the use of a Moore-Penrose pseudo-inverse matrix. Ottersten discloses the method and terminal shown in figure 1. A plurality of receiver antennas receives the incoming signal and provides information to the spatiotemporal processor as well as signal demultiplexors and demodulators. Optimization algorithms are used for calculating the transmit weights that minimize the transmission power according to the system (column 20, lines 49-56). The Moore-Penrose pseudo-inverse matrix is well known (column 23, lines 28-50) and is a component of the received channel response matrix. It would have been obvious for one of ordinary skill in the art at the time of the invention to use a well known matrix used in the calculation of the channel response in the channel response calculation disclosed by Agrawal. Utilizing well known calculation methods allows the method and system to operate at reduced cost since no new development need take place. In addition, accepted and well known methods have been proven to work successfully.

(10) Response to Argument

Arguments by Appellant will be addressed in the same order presented in the appeal brief.

Appellant provides an introduction and legal standards

1. Appellant states independent claim 16 is not anticipated by Agrawal.

Appellant disagrees that Agrawal discloses that a subset of the weighted signals over a sub-group of the plurality of communication channel is received at each receiver on page 12 of the appeal brief. The examiner disagrees with appellant. As stated in the final rejection mailed 10/13/2009, claim 16 does not recite what number of channels or number of weighted signals comprises a sub-group or subset respectively. The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The website, yourdictionary.com, provides the definition of the term “subset” as “a mathematical set in which every element in the set is also contained in a larger set or in an equal set.” A copy of this definition is provided. This was the interpretation of the recited term “subset” used in the rejection of the claim provided in the previous final rejections of the claim. The examiner used the customary and ordinary definition of the term subset. Agrawal discloses the receiver receives the weighted signals. This fact is not argued by appellant. Since a subset is a mathematical

set in which every element in the set is contained in an equal set, the set is the same as the subset, Agrawal discloses receiving a subset (all) of the weighted signals in the receiver. The website, yourdictionary.com, provides a definition of the term “subgroup” as “a group that is a subset of a group.” A copy of this definition is provided. This was the interpretation of the recited term "subgroup" used in the rejection of the claim provided in the previous final rejection of the claim. The examiner used the customary and ordinary definition of the term subgroup. Agrawal discloses the receiver receives the weighted signals over the plurality of communication channels. This fact is not argued by appellant. Since a subgroup is a group that is a subset of a group and a subset is a mathematical set in which every element in the set is contained in an equal set, the group of communication channels is the same as the subgroup, Agrawal discloses receiving a subset (all) of the weighted signals in the receiver over a subgroup (all) of the plurality of communication channels. There is no limitation recited in the claims limiting the terms "subset" or “subgroup" to anything other than the customary and ordinary definition of the terms “subset" or “subgroup”. For these reasons and the reasons stated in the previous office action, the examiner request the rejection of the claim be maintained.

Appellant repeats the argument that Agrawal does not teach or suggest that a subset of the weighted signals over a subgroup of the plurality of communication channels are received at each receive in the first full paragraph of page 13 of the appeal brief. The examiner disagrees for the reasons stated above.

Appellant repeats the argument that Agrawal does not teach or suggest that a subset of the weighted signals over a subgroup of the plurality of communication channels are received at each receive in the second full paragraph of page 13 of the appeal brief. The examiner disagrees for the reasons stated above. In addition, appellant states Agrawal does not teach using inverses of the precoding signal weights associated with the sub-group of the plurality of communication channels. The examiner disagrees. Agrawal discloses the communication system shown in figures 2 and 3. The diagonal elements of the matrix are composed of the weights in the transmitter in column 9, lines 1-6 and 21-32. In the receiver, specifically units 356 and 358, Agrawal discloses the resultant vector is further scaled by an inverse diagonal matrix (column 10, lines 62-67). This inverse diagonal matrix is the inverse of the scaled diagonal matrix in column 9, lines 1-6 and 21-32. The RX data processor 270 obtains the decoded data (column 9, lines 59-62). Therefore, Agrawal discloses decoding the subset of the weighted signals using the inverses of the pre-coding signal weights with the sub-group of the plurality of communication channels.

Appellant states the patent office's position ignores the subset of the weighted signals is decoded using inverses of the pre-coding signal weights based on the channel state information associated with the sub-group of the plurality of communication channels in the third paragraph of page 13 of the appeal brief. The examiner disagrees. As stated in the previous final rejection of the claims, the weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). Agrawal discloses transmitting feedback from the receiver back to the

transmitter comprising the number of data symbol streams, which ones of the channels are used for data transmission and the received SNR or rate for each stream in column 10, lines 8-15. The feedback is processed by a TX data processor (column 10, lines 18-28). The data rate, coding and modulation for each stream may be determined by controls provided by a controller 230 (column 9, lines 39-42). The feedback is a component used to determine the controls provided by the controller. The channel state information will be a component in the transmission of the data at the transmitter and the final recovery of the data in the receiver. Therefore, the decoding is based on the feedback from the receiver which is based on the channel state information associated with the sub-group of the plurality of communication channels (all the received signals at the receiver).

Appellant states Agrawal does not teach that the weighted signals are divided into subsets depending on the particular sub-group and the channel state information associated with it in the first full paragraph of page 14 of the appeal brief. However, the claim does not recite dividing the total number of weighted signals into smaller subsets of weighted signals depending on the particular sub-group. As stated above, the customary and ordinary definition of the terms subset and subgroup do not require a subset to be smaller that the total set. The set and the subset can be equal. For the reasons stated above, Agrawal discloses receiving a subset of the weighted signals over a sub-group of the plurality of communication channels and decoding the subset of the weighted signals using inverses of the pre-coding signal weights based on the

channel state information associated with the sub-group of the plurality of communication channels as recited in the claim.

Claims 2-4, 6-8, 15 and 57- Appellant does not argue the individual limitations of dependent claims 2-4, 6-8, 15 and 57. Therefore, the response to argument for claims 2-4, 6-8, 15 and 57 is the same as the response to argument for claim 16.

2. Appellant states independent claim 13 is not anticipated by Agrawal.

Appellant states independent claim 13 recites limitations similar to those recited in claim 16. The response to argument for claim 16 is referenced to disclose those limitations. Appellant states the specific limitations recited in claim 13 are not taught by Agrawal. The examiner disagrees. Agrawal discloses transmitting the signals over a plurality of channels (column 3, lines 17-28). The signals will comprise a matrix M (column 4, lines 53-56). Matrix M is multiplied by the diagonal elements of the matrix as described in column 9, lines 1-6. This is shown in equation 4 (column 5, lines 13-15). The elements outside of the diagonal of a diagonal matrix are zeros and will force the elements outside of the matrix M to zero. Any value multiplied by a zero will result in a zero value.

3. Applicant states independent claim 17, 32 and 35 are not anticipated by Agrawal.

Claims 17-20, 22, 26-28, 32, 34, 35, 38 and 58-60- Appellant does not argue the individual limitations of dependent claims 17-20, 22, 26-28, 32, 34, 35, 38 and 58-60.

Therefore, the response to argument for claims 17-20, 22, 26-28, 32, 34, 35, 38 and 58-60 is the same as the response to argument for claim 16.

4. Applicant states independent claims 39, 50 and 52 are not anticipated by Agrawal.

Appellant states Agrawal does not teach “determining a special coding matrix comprising a respective set of spatial coding weights for each of the receivers based on the channel state information” as recited in claim 39 in the last paragraph of page 15 of the appeal brief. The examiner disagrees. As stated in the previous final rejection of the claims, the weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). Agrawal discloses transmitting feedback from the receiver back to the transmitter comprising the number of data symbol streams, which ones of the channels are used for data transmission and the received SNR or rate for each stream in column 10, lines 8-15. The feedback is processed by a TX data processor (column 10, lines 18-28). The data rate, coding and modulation for each stream may be determined by controls provided by a controller 230 (column 9, lines 39-42). The feedback is a component used to determine the controls provided by the controller. The channel state information will be a component in the transmission of the data at the transmitter and the final recovery of the data in the receiver. Therefore, the decoding is based on the feedback from the receiver which is based on the channel state information associated with the sub-group of the plurality of communication channels (all the received signals at the receiver). In addition, the diagonal elements of the matrix

are composed of the weights in the transmitter in column 9, lines 1-6 and 21-32. In the receiver, specifically unites 356 and 358, Agrawal discloses the resultant vector is further scaled by an inverse diagonal matrix (column 10, lines 62-67). This inverse diagonal matrix is the inverse of the scaled diagonal matrix in column 9, lines 1-6 and 21-32. The RX data processor 270 obtains the decoded data (column 9, lines 59-62).

Appellant states Agrawal does not teach the limitation of claim 50 which recites “receiving from the transmitter one of a plurality of demodulation matrices for demodulation subsequently received communication signals to which spatial coding weights comprising respective sets of spatial coding weights for a plurality of receivers have been applied" on page 16 of the appeal brief. The examiner disagrees. As stated in the previous final rejection of the claims, the weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). Agrawal discloses transmitting feedback from the receiver back to the transmitter comprising the number of data symbol streams, which ones of the channels are used for data transmission and the received SNR or rate for each stream in column 10, lines 8-15. The feedback is processed by a TX data processor (column 10, lines 18-28). The data rate, coding and modulation for each stream may be determined by controls provided by a controller 230 (column 9, lines 39-42). The feedback is a component used to determine the controls provided by the controller. The channel state information will be a component in the transmission of the data at the transmitter and the final recovery of the data in the receiver. Therefore, the decoding is based on the feedback from the receiver which is based on the channel state information associated with the sub-group

of the plurality of communication channels (all the received signals at the receiver). A matrix in the form of the received signal is received in the receiver. The RX processor will decode the received signal as well as carry out additional function to provide a feedback signal to the transmitter (column 9, lines 59-62). In addition, the diagonal elements of the matrix are composed of the weights in the transmitter in column 9, lines 1-6 and 21-32. In the receiver, specifically unites 356 and 358, Agrawal discloses the resultant vector is further scaled by an inverse diagonal matrix (column 10, lines 62-67). This inverse diagonal matrix is the inverse of the scaled diagonal matrix in column 9, lines 1-6 and 21-32. The RX data processor 270 obtains the decoded data (column 9, lines 59-62).

Appellant states Agrawal does not teach the limitation of the processor of claim 52 on page 16 of the appeal brief. The examiner disagrees. As stated in the previous final rejection of the claims, the weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). Agrawal discloses transmitting feedback from the receiver back to the transmitter comprising the number of data symbol streams, which ones of the channels are used for data transmission and the received SNR or rate for each stream in column 10, lines 8-15. The feedback is processed by a TX data processor (column 10, lines 18-28). The data rate, coding and modulation for each stream may be determined by controls provided by a controller 230 (column 9, lines 39-42). The feedback is a component used to determine the controls provided by the controller. The channel state information will be a component in the transmission of the data at the transmitter and the final recovery of the data in the

receiver. Therefore, the decoding is based on the feedback from the receiver which is based on the channel state information associated with the sub-group of the plurality of communication channels (all the received signals at the receiver). A matrix in the form of the received signal is received in the receiver. The RX processor will decode the received signal as well as carry out additional function to provide a feedback signal to the transmitter (column 9, lines 59-62). In addition, the diagonal elements of the matrix are composed of the weights in the transmitter in column 9, lines 1-6 and 21-32. In the receiver, specifically unites 356 and 358, Agrawal discloses the resultant vector is further scaled by an inverse diagonal matrix (column 10, lines 62-67). This inverse diagonal matrix is the inverse of the scaled diagonal matrix in column 9, lines 1-6 and 21-32. The RX data processor 270 obtains the decoded data (column 9, lines 59-62).

Claims 40-43, 48, 49, 51 and 53-55- Appellant does not argue the individual limitations of dependent claims 40-43, 48, 49, 51 and 53-55. Therefore, the response to argument for claims 40-43, 48, 49, 51 and 53-55 is the same as the response to argument for claims 39, 50 and 52.

Claim 54- Agrawal discloses the transmitters in figure 2. These elements that transmit the RF signals are the beamformers since the transmitter will control the signals to be transmitted

5. Appellant states claims 10-12, 23-25, 33, 36 and 37 are not obvious over Agrawal in view of Catreux.

Claims 10-12, 23-25, 33, 36 and 37- Appellant does not argue the individual limitations of dependent claims 10-12, 23-25, 33, 36 and 37. Therefore, the response to argument for claims 10-12, 23-25, 33, 36 and 37 is the same as the response to argument for their corresponding independent claim.

6. Appellant states claim 21 is not obvious over Agrawal in view of Ottersten.

Claim21- Appellant does not argue the individual limitations of dependent claim 21. Therefore, the response to argument for claim 21is the same as the response to argument for claim 17.

(11) Related Proceedings Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Kevin M. Burd/

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Conferees:

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